Section 3

Remedial Investigation

Contents

Remedial Investigation

Introduction

The purpose of a remedial investigations (herein "RI") to gather adequate information regarding petroleum releases to make reliable cleanup and closure decisions. RIs are typically completed immediately following the discovery of high-priority releases but may also be delayed at lower priority releases by the Department of Environmental Quality (herein "DEQ").

The requirement for owners and operators of petroleum storage tanks (herein "O/O") to conduct RIs and the general description of an RI is outlined in Administrative Rules of Montana (ARM) 17.56.604, which states:

> In order to determine the full extent and location of soils contaminated by the release and the presence and concentrations of free and dissolved product contamination in the surface and water and in groundwater, owners and operators must conduct a remedial investigation of the release, the release site, and the surrounding area possibly affected by the release…
>
> A remedial investigation generally is an expanded site assessment more detailed in scope than the initial response and abatement measures under ARM 17.56.602, which must define the nature, extent, and magnitude of contamination and identify threats to public health, welfare and to the environment.

Remedial Investigation Goals

A complete RI must determine with a reasonable amount of scientific certainty all of the following:

1. Background of the release, including all known and suspected sources of the release, known and potential impacts of the release, and actions taken to address the release.

2. Site history, including all relevant information concerning the current and historical activities and physical and legal aspects of the site that may affect the release, its impacts to human health and the environment, or its investigation and cleanup.

3. The extent, location, and concentration of contamination in soil, surface water, and groundwater.

    a. The extent of **soil contamination** must be determined through sampling and laboratory analysis to the limits bounded by concentrations less than reporting limits listed in ARM 17-56-506(1)(b). These reporting limits include risk-based screening levels (herein "RBSLs") published in Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases, (dated October 2003), and Preliminary Remediation Goals published by the U.S. EPA Region 9 for contaminants not listed in RBCA. The lateral and vertical extent must be measured for both surface and subsurface contamination.

    b. The extent of **surface water and groundwater contamination** must be determined to limits bounded by no detectable concentrations of the contaminant

at the best achievable practical concentration limits typically achieved by laboratories, for greatest seasonal extent of the contamination plume.

c. The extent of contamination in any other media such as soil gas, vapors collecting inside structures and utility lines (including backfilled bedding material) must also be measured when applicable.

d. DEQ will consider exemptions to this requirement to fully identify the extent and magnitude of the release on a case-by-case basis, based on inaccessibility and impracticability of gathering the data.

4. Identification of current and reasonably potential future receptors that may be impacted by the release. All potential receptors must be listed whether an impact has been proven or discounted. A discussion of the data supporting how the receptor is or is not impacted may be included.

5. Investigation of all probable routes of exposure from the release to identified receptors. In addition to the typical routes such as direct contact and drinking of groundwater the RI must also investigate routes such as vapor intrusion into building, permeation of water supply lines, or any other potential pathway.

Standardized CAP and Report formats are Applicable to Most Release Investigations

Standardized CAP and report formats discussed in this guidance should address the majority of release sites. However, DEQ understands that they may not address the needs of every release. The O/Os should conform to standardized formats in this guidance whenever possible to facilitate review of documents and to ensure adequate information is collected to make proper decisions to safeguard human health and the environment. When DEQ project manager (herein "PM") determines non-standard site-specific CAPs and/or reports are necessary, they will clearly outline precisely what will be required and use as much of the standardized CAP and Report formats as possible. Only DEQ PMs the can approve modification to the CAP and report formats in this guidance, or the use of site-specific CAPs and reports. Approval to use CAP and report formats must be granted by DEQ before the work is completed, and not after the fact. Owners and operators are encouraged to contact the PM to clarify any portion of a work request they do not fully understand, or to confer on draft work products as they are being prepared.

RIs May be Completed in Phases

Because the full extent and magnitude of a release is unknown until an RI is completed, it is not uncommon for the first phase of an RI to only identify a portion of the full release. Therefore O/Os may need to conduct several phases of investigatory work to fully define the release. Each subsequent phase of work building upon information discovered during previous phases of work.

Request for an Initial RI CAP

When a DEQ PM requests a remedial, the O/O should prepare a CAP in accordance with the standardized CAP for Remedial Investigations (CAP RI-01). Sections 4.3 and 6.8 through 6.15 should only be included in the CAP if they are specifically requested by the PM. The PM may also provide site-specific guidance to the O/O for additional items to be included or excluded in the RI. The O/O is encouraged to contact the DEQ PM for any issues they may not understand in the completion of the CAP.

The CAP will be reviewed and approved by the PM if it meets the requirements of the Standardized CAP RI-01 and site-specific guidance provided by the PM. The O/O will be notified of DEQ's approval and given a timeframe to have the work outlined in the CAP completed and a report submitted to DEQ. If the release is potentially eligible, the Petroleum Tank Release Compensation Board staff will also be notified.

RI Report

Once fieldwork is completed and data gathered, the O/O must document the results of the investigation in accordance with the standardized report for an Remedial Investigation at a Petroleum Release Site (Report_RI-01), and any additional guidance provided by the PM in the approval letter. If the O/O identifies any unexpected conditions that may pose an immediate risk to receptors at any time during the investigation, the O/O should immediately notify the PM and take steps to mitigate the risks.

Request for Additional RI

When additional information is needed to characterize the release beyond the initial RI, the PM will request the O/O to prepare a CAP to address additional investigative work. The requested CAP may be in the form of a thorough Additional Remedial Investigation CAP (CAP RI-02), an abbreviated CAP (AC-00 through AC-07), or a site-specific CAP specified by the PM. The PM will clearly identify what CAP format is required when requesting the O/O to complete additional work. [Section 7 of this guidance discusses Abbreviated CAPs and Reports.]

Additional RI Reports

Reports documenting investigatory work beyond an Initial RI may take many forms depending on the tasks completed and requirements of the PM. The PM will most often require the O/O to complete and submit a report that includes only relevant sections of the RI Report format (Report_RI-01) that address the specific tasks completed. In few cases the PM will request an updated complete stand-alone RI Report (Report_RI-01) with the additional information included. The PM may also request an abbreviated report format (AR-00 through AR-07). The PM will clearly identify what report is required when requesting the O/O to complete additional work. [Section 7 of this guidance discusses Abbreviated CAPs and Reports.]

CAP RI-01

Standardized Corrective Action Plan for an Initial Remedial Investigation

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY PETROLEUM RELEASE SECTION (PRS)
(Revised September 4, 2003)

The following lists minimal requirements for an Initial Remedial Investigation Corrective Action Plan. Please omit any section describing tasks that were not requested by the department and note the omission in the RI report.

1. C OVER LETTER (This letter should be no longer than one page)

1.1 Date
1.2 Responsible Party's Name and Mailing Address
1.3 Contact Person's Name and Mailing Address (if different from above).
1.4 Subject Line with the following information:
1.5 Title (Corrective Action Plan and Budget for Remedial Investigation) for the petroleum release at (Facility Name, Street Address, Town), MT (Zip Code); DEQ Facility ID (Number) and Release (Number).
1.6 Introductory paragraph containing reference to DEQ's request for corrective action plan, and general scope of work to be conducted.
1.7 Consultant's Name, Address and Phone Number (if not on letterhead).
1.8 Name of person who prepared the workplan

2. BACKGROUND NARRATIVE (this portion of the workplan should be used as section 4.0 of the RI report)

2.1 When, how, and by whom contamination was discovered.
2.2 Type of products stored at site.
2.3 Type of contamination.
2.4 When and who reported the release to DEQ.
2.5 Summary of initial actions undertaken and by whom.
2.6 Summary of regulatory history.
2.7 Current site status. What work has already been done and what do we already know about the release and its potential threats to human health and the environment?

3. SUMMARY OF SITE CONDITIONS

3.1 What is the local soil type and how will that affect contaminant fate and transport?
3.2 Is a community water supply in place, or do residents use individual wells?
3.3 What is the depth to first groundwater?
3.4 What are the contaminants of concern and potential concern?

4. MAPS

4.1 Location map — preferably a reproduction of a USGS topographic map; to be used as section 6.3 of report.

4.2 Facility sketch/map. A true scale digitized base map is preferred that can be later used as a base for all other maps provided in the report. If a true scale map has not yet been prepared, then a "best estimate" site sketch may be acceptable for simple sites. The facility sketch should show the following:

- 4.2.1 All known and suspected sources of petroleum (tanks, pipes, dispensers, waste pits, French drains,…etc.) (current and historical).
- 4.2.2 Facility buildings
- 4.2.3 Property lines and easements
- 4.2.4 Known and estimated utilities (buried and overhead)
- 4.2.5 Surface cover
- 4.2.6 Adjacent buildings and property use
- 4.2.7 Locations of environmental and construction activities pertinent to the release (excavations, test pits, soil borings, samples….etc.)
- 4.2.8 Water wells
- 4.2.9 Local topographic slope
- 4.2.10 Expected or known flow direction of groundwater.
- 4.2.11 Location of surface water bodies
- 4.2.12 North arrow and scale

4.3 Aerial Photograph (if required/approved by DEQ)

5. PURPOSE AND OBJECTIVES OF INVESTIGATION (this portion of the workplan should be used as section 5.0 when preparing the RI report)

5.1 Specific goals of this investigation

5.2 Identify and state the purpose and objectives of each task

6. PROPOSED WORK

Some types of work will always be included in Initial Remedial Investigations, where other work may only be necessary on a site-specific basis. The DEQ project manager will use professional judgment to determine what types of additional investigations or information gathering is necessary to adequately document site conditions and evaluate risk. Sections 6.1 through 6.7 and section 6.16 are required to be completed for all Initial Remedial Investigations. Sections 6.8 through 6.15 should be included only if they have been requested by the DEQ project manager.

6.1 Initial site reconnaissance (This may be verbally approved by DEQ project manager prior to workplan approval)

6.2 Preparation of workplan (This may be verbally approved by DEQ project manager prior to workplan approval)

6.3 Project management

- 6.3.1 Client consultation
- 6.3.2 DEQ consultation
- 6.3.3 Preparing scopes of work an soliciting bids from subcontractors
- 6.3.4 Telephone calls
- 6.3.5 Tracking budget

6.4 Map preparation
- 6.4.1 Site mapping
- 6.4.2 Drafting

6.5 Travel

6.6 Receptor Survey
- 6.6.1 Identification of all potential receptors in the area.
- 6.6.2 Identification of migration pathways and discussion of potential completion.
- 6.6.3 Preparation of maps and/or aerial photographs (if requested)

6.7 Extent and Magnitude of Contamination
- 6.7.1 Data compilation and analysis
- 6.7.2 Preparation of map, cross-section, and/or aerial photographs (if requested)

6.8 Site History (if requested)
- 6.8.1 Ownership research (at least back to the time at which the release from the tank could have occurred)
- 6.8.2 Site operational research (at least back to the time at which the release from the tank could have occurred)
- 6.8.3 Research of all releases that occurred on the facility.
- 6.8.4 Preparation of maps and/or aerial photographs (if requested)

6.9 Soil Investigation (if requested)
- 6.9.1 Description of methodology (test pits, borings, direct push…etc.)
- 6.9.2 Sampling methodology (collection, field screening, and analysis)
- 6.9.3 Sample location map.
- 6.9.4 QA/QC plan (may be on-file with DEQ, or included in an appendix)
- 6.9.5 Data compilation and synthesis
- 6.9.6 Preparation of maps, cross-sections, and/or aerial photographs (if requested)

6.10 Groundwater Investigation (if requested)
- 6.10.1 Description of methodology (existing supply wells, monitoring wells, direct push…etc.)
- 6.10.2 Sampling methodology (collection, field screening, and analysis)
- 6.10.3 Proposed sample location map.
- 6.10.4 QA/QC plan (may be on-file with DEQ, or included in an appendix)
- 6.10.5 Data compilation and synthesis
- 6.10.6 Preparation of maps, cross-sections, and/or aerial photographs (if requested)

6.11 Soil Vapor Investigation (if requested)
- 6.11.1 Description of methodology
- 6.11.2 Sampling methodology (collection, field screening, and analysis)
- 6.11.3 Proposed Sample location map.
- 6.11.4 QA/QC plan (may be on-file with DEQ, or included in an appendix)
- 6.11.5 Data compilation and synthesis (must include field instrument calibration)
- 6.11.6 Preparation of maps, cross-sections, and/or aerial photographs (if requested)

6.12 Structure Vapor Intrusion Investigation (if requested)
- 6.12.1 Description of methodology
- 6.12.2 Sampling methodology (collection, field screening, and analysis)
- 6.12.3 Proposed sample location map and diagrams of buildings.
- 6.12.4 QA/QC plan (may be on-file with DEQ, or included in an appendix)
- 6.12.5 Data compilation and synthesis (must include field instrument calibration)
- 6.12.6 Preparation of maps, cross-sections, and/or aerial photographs (if requested)

6.13 Utility Investigation (if requested)
- 6.13.1 Utility research [note: a limited amount of research can be pre-approved in order to prepare this workplan]
- 6.13.2 Description of methodology (test pits, borings, internal inspection…etc.)
- 6.13.3 Sampling methodology (collection, field screening, and analysis)
- 6.13.4 Proposed sample location map.
- 6.13.5 QA/QC plan (may be on-file with DEQ, or included in an appendix)
- 6.13.6 Data compilation and synthesis
- 6.13.7 Preparation of maps, cross-sections, and/or aerial photographs (if requested)

6.14 Other Data Results (if requested)

6.15 Migration pathways and exposure potential evaluation (if requested)
- 6.15.1 Description of methodology
- 6.15.2 Data compilation and synthesis

6.16 Report Preparation
- 6.16.1 Data consolidation and tabulation
- 6.16.2 Data evaluation
- 6.16.3 Report writing

7. SCHEDULE

Include times when phases of work will begin, when they will be completed, and when information and reports will be provided to DEQ. If specific dates cannot be determined until after the CAP is approved, then provide generic timeframes.

8. BUDGET

9. APPENDICES

9.1 Quality assurance/quality control (QA/QC) plan for all methods and sampling proposed (may be on file with DEQ)

9.2 Standard operating procedures (SOPs) for all methods and sampling proposed (may be on file with DEQ)

9.3 Disposal of investigation derived waste plan.

CAP RI-02
Standardized Corrective Action Plan for an Additional Remedial Investigation

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY PETROLEUM RELEASE SECTION (PRS)
(Revised October 8, 2003)

The following lists minimal requirements for an Additional Remedial Investigation Corrective Action Plan. Please omit any section describing tasks that were not requested by the department and note the omission in the RI report.

1. C OVER LETTER (This letter should be no longer than one page)
- 1.1 Date
- 1.2 Responsible Party's Name and Mailing Address
- 1.3 Contact Person's Name and Mailing Address (if different from above).
- 1.4 Subject Line with the following information:
- 1.5 Title (Corrective Action Plan and Budget for Remedial Investigation) for the petroleum release at (Facility Name, Street Address, Town), MT (Zip Code); DEQ Facility ID (Number) and Release (Number).
- 1.6 Introductory paragraph containing reference to DEQ's request for corrective action plan, and general scope of work to be conducted.
- 1.7 Consultant's Name, Address and Phone Number (if not on letterhead).
- 1.8 Name of person who prepared the workplan

2. BACKGROUND NARRATIVE (this portion of the workplan should be updated from Section 4.0 of the Initial RI Report)
- 2.1 When, how, and by whom contamination was discovered.
- 2.2 Type of products stored at site.
- 2.3 Type of contamination.
- 2.4 When and who reported the release to DEQ.
- 2.5 Summary of initial actions undertaken and by whom.
- 2.6 Summary of regulatory history.
- 2.7 Current site status. What work has already been done and what do we already know about the release and its potential threats to human health and the environment?

3. SUMMARY OF SITE CONDITIONS
- 3.1 What is the local soil type and how will that affect contaminant fate and transport?
- 3.2 Is a community water supply in place, or do residents use individual wells?
- 3.3 What is the depth to first groundwater?
- 3.4 What are the contaminants of concern and potential concern?

4. MAPS
- 4.1 Location map — preferably a reproduction of a USGS topographic map; to be used as section 6.3 of report.
- 4.2 Facility sketch/map. A true scale digitized base map is preferred that can be later used as a base for all other maps provided in the report. If a true scale map has not yet been

prepared, then a "best estimate" site sketch may be acceptable for simple sites. The facility sketch should show the following:

- 4.2.1 All known and suspected sources of petroleum (tanks, pipes, dispensers, waste pits, French drains,…etc.) (current and historical).
- 4.2.2 Facility buildings
- 4.2.3 Property lines and easements
- 4.2.4 Known and estimated utilities (buried and overhead)
- 4.2.5 Surface cover
- 4.2.6 Adjacent buildings and property use
- 4.2.7 Locations of environmental and construction activities pertinent to the release (excavations, test pits, soil borings, samples….etc.)
- 4.2.8 Water wells
- 4.2.9 Local topographic slope
- 4.2.10 Expected or known flow direction of groundwater.
- 4.2.11 Location of surface water bodies
- 4.2.12 North arrow and scale

4.3 Aerial Photograph (if required/approved by DEQ)

5. PURPOSE AND OBJECTIVES OF INVESTIGATION (this portion of the workplan should be used as section 5.0 when preparing the RI report)

5.1 Specific goals of this investigation

5.2 Identify and state the purpose and objectives of each task

6. PROPOSED WORK

Some types of work will always be included in Initial Remedial Investigations, where other work may only be necessary based on site-specific conditions and requirements. The PRS project manager will use professional judgment to determine what types of additional investigations or information gathering is necessary to adequately document site conditions and evaluate risk. Sections 6.1 through 6.7 and section 6.16 are required to be completed for all Initial Remedial Investigations. Sections 6.8 through 6.15 should be included only if they have been requested by the PRS project manager.

6.1 Initial site reconnaissance (This may be verbally approved by DEQ project manager prior to workplan approval)

6.2 Preparation of workplan (This may be verbally approved by DEQ project manager prior to workplan approval)

6.3 Project management

- 6.3.1 Client consultation
- 6.3.2 DEQ consultation
- 6.3.3 Preparing scopes of work an soliciting bids from subcontractors
- 6.3.4 Telephone calls
- 6.3.5 Tracking budget

6.4 Map preparation

- 6.4.1 Site mapping

6.4.2 Drafting

6.5 Travel

6.6 Receptor Survey

6.6.1 Identification of all potential receptors in the area.

6.6.2 Identification of migration pathways and discussion of potential completion.

6.6.3 Preparation of maps and/or aerial photographs (if requested/approved)

6.7 Extent and Magnitude of Contamination

6.7.1 Data compilation and analysis

6.7.2 Preparation of map, cross-section, and/or aerial photographs (if requested/approved)

6.8 Site History (if requested)

6.8.1 Ownership research (at least back to the time at which the release from the tank could have occurred)

6.8.2 Site operational research (at least back to the time at which the release from the tank could have occurred)

6.8.3 Research of all releases that occurred on the facility.

6.8.4 Preparation of maps and/or aerial photographs (if requested/approved)

6.9 Soil Investigation (if requested)

6.9.1 Description of methodology (test pits, borings, direct push…etc.)

6.9.2 Sampling methodology (collection, field screening, and analysis)

6.9.3 Proposed sample location map.

6.9.4 QA/QC plan (may be on-file with DEQ, or included in an appendix)

6.9.5 Data compilation and synthesis

6.9.6 Preparation of maps, cross-sections, and/or aerial photographs (if requested/approved)

6.10 Groundwater Investigation (if requested)

6.10.1 Description of methodology (existing supply wells, monitoring wells, direct push…etc.)

6.10.2 Sampling methodology (collection, field screening, and analysis)

6.10.3 Sample location map.

6.10.4 QA/QC plan (may be on-file with DEQ, or included in an appendix)

6.10.5 Data compilation and synthesis

6.10.6 Preparation of maps, cross-sections, and/or aerial photographs (if requested/approved)

6.11 Soil Vapor Investigation (if requested)

6.11.1 Description of methodology

6.11.2 Sampling methodology (collection, field screening, and analysis)

6.11.3 Proposed sample location map.

6.11.4 QA/QC plan (may be on-file with DEQ, or included in an appendix)

6.11.5 Data compilation and synthesis (must include field instrument calibration)

6.11.6 Preparation of maps, cross-sections, and/or aerial photographs (if requested/approved)

6.12 Structure Vapor Intrusion Investigation (if requested)

6.12.1 Description of methodology

6.12.2 Sampling methodology (collection, field screening, and analysis)

6.12.3 Proposed sample location map and diagrams of buildings.

6.12.4 QA/QC plan (may be on-file with DEQ, or included in an appendix)
6.12.5 Data compilation and synthesis (must include field instrument calibration)
6.12.6 Preparation of maps, cross-sections, and/or aerial photographs (if requested/approved)

6.13 Utility Investigation (if requested)
6.13.1 Utility research [note: a limited amount of research can be pre-approved in order to prepare this workplan]
6.13.2 Description of methodology (test pits, borings, internal inspection…etc.)
6.13.3 Sampling methodology (collection, field screening, and analysis)
6.13.4 Proposed sample location map.
6.13.5 QA/QC plan (may be on-file with DEQ, or included in an appendix)
6.13.6 Data compilation and synthesis
6.13.7 Preparation of maps, cross-sections, and/or aerial photographs (if requested/approved)

6.14 Other Data Results (if requested)

6.15 Migration pathways and exposure potential evaluation (if requested)
6.15.1 Description of methodology
6.15.2 Data compilation and synthesis

6.16 Report Preparation
6.16.1 Data consolidation and tabulation
6.16.2 Data evaluation
6.16.3 Report writing

7. SCHEDULE

Include times when phases of work will begin, when they will be completed, and when information and reports will be provided to DEQ. If specific dates cannot be determined until after the CAP is approved, then provide generic timeframes.

8. BUDGET

9. APPENDICES

9.1 Quality assurance/quality control (QA/QC) plan for all methods and sampling proposed (may be on file with DEQ)

9.2 Standard operating procedures (SOPs) for all methods and sampling proposed (may be on file with DEQ)

9.3 Disposal of investigation derived waste plan.

Report RI-01
Standardized Report for an
Initial Remedial Investigation at a Petroleum Release Site

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY PETROLEUM RELEASE SECTION (PRS)
(Revised June 4, 2003)

The following lists minimal requirements for a Remedial Investigation Report. Some of the listed sections may not apply to the scope of work conducted under the approved RI CAP for the release. Omit any section in the Standardized RI Report which does not apply to the scope of work conducted under the RI CAP, and provide an explanation for the omission in the RI Report.

The following outline provides owner/operators and consultants with basic information that a **Remedial Investigation Report at a Petroleum Release Site** must contain before it will be reviewed by PRS.

A Remedial Investigation Report is required to determine the extent and magnitude of contamination associated with a petroleum release and to evaluate the risk it poses to human health and the environment. The PRS project manager will use professional judgment to determine what types of additional investigations or information gathering is necessary to adequately document site conditions and evaluate risk. The report format listed herein includes most of the typical technologies that may be required as part of a remedial investigation. Not all of these sections may be required for individual release sites. When sections of this report format are not included in the remedial investigation, omit those sections and make a brief annotation in the report that they were not required.

Following the collection and analysis of field data, it may become apparent that additional investigation will be required to determine the full extent and magnitude of contamination and to evaluate the risk it poses to human health and the environment. Additional investigations may be required to gather this additional information and to complete the remedial investigation. When this occurs, additional information should be included in separate Additional Investigation Reports.

1. TITLE PAGE

1.1 Title of report ["Initial Remedial Investigation for…"]
1.2 Facility name.
1.3 Facility address.
1.4 DEQ Facility ID Number and Release Number.
1.5 Responsible parties name, mailing address and phone number.
1.6 Consultant's name, address and phone number.
1.7 Contact persons name, mailing address and phone number (if different from above).
1.8 Date report prepared.
1.9 Title and date of approved RI CAP

2. EXECUTIVE SUMMARY

Executive summary of the report that highlights the significant methods of investigation, findings, conclusions, and recommendations of the investigation.

3. TABLE OF CONTENTS

3.1 Includes titles of report sections and page numbers (please use naming/numbering methodology for main sections listed herein).
3.2 Lists of tables and figures.
3.3 List of appendices.

4. **BACKGROUND**

4.1 When, how, and by whom contamination was discovered.
4.2 Type of products stored at site.
4.3 Type of contamination.
4.4 When and who reported the release to DEQ.
4.5 Summary of initial actions undertaken and by whom.
4.6 Summary of regulatory history.
4.7 Current site status. What work has already been done and what do we already know about the release and its potential threats to human health and the environment?

5. PURPOSE AND OBJECTIVES OF INVESTIGATION

5.1 Specific goals of this investigation
5.2 Identify general tasks, state the purpose and objectives of each task

6. SITE HISTORY (if completed)

6.1 History of the ownership and operation of the facility, since at least the time at which the release from the tank could have occurred, including the following:
- 6.1.1 The name, current address and telephone number of all current owners and operators;
- 6.1.2 The name, current address and telephone number (if known) of all past owners and operators,
- 6.1.3 The years of current and past ownership and/or operation,
- 6.1.4 A description of the activities conducted at the site by each current and past owner/operator,
- 6.1.5 A general construction history of the site,
- 6.1.6 Former and existing hazardous material/waste storage areas, lagoons and waste pits, and
- 6.1.7 Waste management history.

6.2 History of operation of ASTs and USTs since at least the time at which the release from the tank did or could have occurred at the site, including the following (some or all of this information may be presented in tabular form):
- 6.2.1 Dates of installation and removal of all existing and former tanks located on the site,
- 6.2.2 Volume of tank(s),
- 6.2.3 Tank and piping construction material,
- 6.2.4 Tank configuration, piping layout, check valves,

6.2.5 Overfill/spill protection,
6.2.6 Cathodic protection,
6.2.7 Date and description of repairs, replacements, modifications to tanks and ancillary,
6.2.8 Condition of tank(s)/piping if removed, location and size of perforations,
6.2.9 Method and results of product inventory reconciliation (describe and attach copies of product inventory charts).

6.3 A description of all known and suspected leaks, spills, overfills or other releases from the UST, ASTs, and any other petroleum sources located on the site. The following information should be included for each occurrence:
6.3.1 Date of release,
6.3.2 Date release was reported to the department,
6.3.3 Type of product(s) released,
6.3.4 Quantity released,
6.3.5 Quantity recovered,
6.3.6 Known or suspected cause of the release,
6.3.7 Location of the release on the site,
6.3.8 Cleanup action taken, and
6.3.9 Offsite effects.

7. MAPS AND SITE TECHNICAL INFORMATION

7.1 Facility site map or maps and descriptions or symbols appropriate in scale and scope showing the following within a 500 foot (unless otherwise noted) radius of the site (information may be shown on more than one map for clarity):
7.1.1 Existing and former USTs, ASTs, piping, dispensers, and other sources of petroleum,
7.1.2 Soil boring, test pit, or other sample locations (if completed),
7.1.3 Locations of any other environmental samples collected,
7.1.4 Monitoring wells (if completed),
7.1.5 Recovery wells (if completed),
7.1.6 Other remediation equipment (if installed),
7.1.7 Underground utilities on and adjacent to the property (sewer, water, telephone, electric),
7.1.8 Above ground utilities (overhead wires)
7.1.9 Basements and tile drain and sump systems on the facility and adjacent to the property,
7.1.10 Existing and former hazardous material/waste storage areas,
7.1.11 Adjacent buildings (structures),
7.1.12 Domestic, municipal and irrigation wells.
7.1.13 North arrow and scale

7.2 Local map (2-3 city block area) showing utilities, residences, wells, business or building use (children's nursery or machine shop?), potential third parties depending on contamination type, property lines, magnitude and extent of soil and groundwater contamination.

7.3 Topographic map of site and surrounding area.

7.4 Surface water technical information and map(s), including:
- 7.4.1 Location and use of all surface water within 1 mile of site,
- 7.4.2 Groundwater/surface water discharge points,
- 7.4.3 Sampling description,
- 7.4.4 Results of laboratory analysis.

7.5 Site map showing the aerial extent of free product based on subsurface investigatory methods (e.g. monitoring wells, soil borings, direct push technology).

7.6 Location, ownership, use and construction of all municipal, domestic, irrigation, industrial and monitoring wells within ½ mile of the site,

8. RECEPTOR SURVEY

8.1 Identification of all potential receptors in the area of contamination and possible migration.
- 8.1.1 Drinking water
  - 8.1.1.1.Groundwater wells
  - 8.1.1.2.Permeable water mains
  - 8.1.1.3.Permeable water service connections
- 8.1.2 Vapors in structures
  - 8.1.2.1.Residences/public buildings
  - 8.1.2.2.Utility vaults
  - 8.1.2.3.Commercial buildings
- 8.1.3 Direct dermal contact with surface soil (< 2ft bgs)
  - 8.1.3.1.Residential property
  - 8.1.3.2.Commercial property
  - 8.1.3.3.Recreational property
- 8.1.4 Buried utilities
  - 8.1.4.1.Open utilities (water, sewer,…)
  - 8.1.4.2.Close utilities (phone, power,…)
- 8.1.5 Surface water
  - 8.1.5.1.Lakes, rivers, ponds
  - 8.1.5.2.Wetlands
  - 8.1.5.3.Storm sewers
- 8.1.6 Groundwater (not used for drinking, but protected as ‘state water’)

8.2 Migration Pathway Identification
- 8.2.1 [Identify all pathways that may be completed from the contamination source to all potential receptors identified 1. Include one sub-section for each identified receptor.]

8.3 Exposure Potential Discussion

8.4 [Evaluate potential for pathways identified in Sub-Section 8.2 to be complete. Include one sub-section for each pathway identified in Sub-Section 8.2.]

9. EXTENT AND MAGNITUDE OF CONTAMINATION

9.1 Describe evidence of releases of petroleum to the environment including visual and olfactory evidence, results of field screening, laboratory analysis and historical knowledge.

9.2 Types, concentrations and volumes (if applicable) of all released petroleum and hazardous material detected to date at the facility.
9.3 Analytical results for each media sampled shall be summarized in the text and in tables in the body of the report.
9.4 Information and details on the approximate horizontal and vertical extent of soil contamination, on-site and off-site, based on best available information.
9.5 Information and details on the approximate horizontal and vertical extent of free-phase petroleum, on-site and off-site, based on best available information.
9.6 Information and details on the approximate horizontal and vertical extent of petroleum vapors, on-site and off-site, based on best available information.
9.7 Describe and discuss the extent and magnitude of all contamination associated with this release or commingled from other sources that will impact, potential risks to human health and the environment, fate and transport and implications for corrective action. Discuss where the contamination is, how much is there (mass and volume in each location), how it came to be located there, and where it may migrate in the future. Discuss how these data will impact an analysis of cleanup alternatives.

10. SOIL INVESTIGATION (if completed)

10.1 Description of soil investigation
- 10.1.1 Description of methods (backhoe pits, borings and monitoring well installation, vapor sampling, heated headspace sampling, and other field screening methods). A separate description should be described for each method used,
- 10.1.2 QA/QC plan (may be on file at DEQ),
- 10.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file,

10.2 Description of soil from test pits, boring completion, or other sample retrieval methods,
10.3 Field screening results (visual, odors, and vapor survey results) in tabular form with date and time of measurement, depth, location, penetration measurement if taken; time-series graphs and tables if more than one sampling period,
10.4 Isopleths of concentrations shown on map, possible cross-section of sampling results, if samples taken from more than one depth,
10.5 Groundwater sampling results (if encountered and sampled from excavation/borings; this information may be included in groundwater investigation section),
10.6 Depth to water and water table elevation measurements (if encountered in excavation/borings; this information may be included in groundwater investigation section),
10.7 Soil type, thickness, and classification below the site of the release,
10.8 Unconsolidated material and bedrock type, thickness, and formation name below the site of the release,
10.9 Soil characteristics (grain size, sorting, origin, texture, permeability, classification),
10.10 Boring logs and monitoring well logs (may be presented in appendix) (contaminant screening levels, sediment olfactory observations and vapor readings, and blow count),
10.11 Geologic cross-section from boring/excavation information (if applicable),

10.12 Soil sample analytical results (presented in tabular form),
10.13 Vertical extent of contamination (Include updated soil contamination extent and magnitude map, if applicable).
10.14 Discussion of sampling or analytical anomalies.

11. GROUNDWATER INVESTIGATION (if completed)

11.1 Description of groundwater investigation
- 11.1.1 Description of methods (backhoe pits, borings and monitoring well installation, vapor sampling, heated headspace sampling, and other field screening methods). A separate description should be described for each method used,
- 11.1.2 QA/QC plan (may be on file at DEQ),
- 11.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file.

11.2 General description and characteristics of aquifers and unsaturated zone below the site of the release, including:
- 11.2.1 Hydraulic characteristics,
- 11.2.2 Depth to water table (multiple measurements should be presented in a tabular format),
- 11.2.3 Surveyed water elevations and contours (potentiometric surface),
- 11.2.4 Water table peizometric surface contour map,
- 11.2.5 Direction of groundwater flow,
- 11.2.6 Rate of groundwater flow,
- 11.2.7 Perched or confined aquifer conditions,
- 11.2.8 Connections to other aquifers, and
- 11.2.9 Hydrologic cross sections.

11.3 Description of monitoring well, or sampling point completion (description of well, well construction methods, well construction or completion diagram) (may be presented in appendix).
11.4 Field screening results in table form with date and time of measurement, depth, location, penetration measurement if taken; time-series graphs and tables if more than one sampling period.
11.5 Results of laboratory analysis (multiple measurements should be presented in a tabular format).
11.6 Isopleth (iso-concentration) map depicting at least one analyte for each contaminant type (gasoline, diesel…etc.) that best depicts the extent and magnitude of that contaminant. Consult PRS project manager for selection of analytes depicted.
11.7 Discussion of sampling or analytical anomalies

12. SOIL VAPOR INVESTIGATION (if completed)

12.1 Description of vapor investigation
- 12.1.1 Description of methods used to evaluate potential migration of petroleum vapors into utilities or structures. A separate description should be described for each method used.
- 12.1.2 QA/QC plan (may be on file at DEQ).

12.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file.
12.1.4 Vapor measuring instrument calibration data.
12.1.5 Type instrument(s) used for vapor measurements.
12.2 Weather conditions during collection of vapor readings.
12.3 Detailed site map vapor sampling locations.
12.4 Description of surface and subsurface structures that may influence the migration of vapors through the soil.
12.5 Description of soil vapor sampling points and soil conditions recorded during driving of sampling points (if taken).
12.6 Field observations made during sampling.
12.7 Field screening, qualitative, or quantitative results in table form with date and time of measurement, depth, location, and penetration measurement if taken.
12.8 Groundwater sampling results (if encountered and sampled from vapor sampling points; This information may be included in groundwater investigation section).
12.9 Depth to water and water table elevation measurements (if encountered in sampling points).
12.10 Geologic cross-section from borings/excavations showing vapor concentrations (if applicable).
12.11 Isopleths of concentrations shown on map, possible cross-section of sampling results if samples taken from more than one depth.
12.12 Map(s) showing the extent of free product, dissolved groundwater phase, and vapors discovered in basements and other subsurface structures and utilities.
12.13 Map(s) showing all structures and subsurface utilities present near the site that are, or may become, impacted by petroleum vapors associated with the release.
12.14 An evaluation of the potential for petroleum vapors to migrate into structures and subsurface utilities. Including calculations on vapor migration potential under existing site conditions.
12.15 Discussion of sampling or analytical anomalies.

13. STRUCTURE VAPOR INTRUSION INVESTIGATION (if completed)

13.1 Description of vapor investigation
13.1.1 Description of methods used to evaluate potential migration of petroleum vapors into utilities or structures. A separate description should be described for each method used.
13.1.2 QA/QC plan (may be on file at DEQ).
13.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file.
13.1.4 Vapor measuring instrument calibration data.
13.1.5 Type instrument(s) used for vapor measurements.
13.2 Weather conditions during collection of vapor readings.
13.3 Vapor sample locations shown on map.
13.4 Detailed site map vapor sampling locations with respect to petroleum contamination (soil, free product, groundwater, and soil vapors) to the extent known.

13.5 Description of surface and subsurface structures that may influence the migration of vapors through the soil.
13.6 Description of structure vapor sampling points and other conditions within structures that may influence sampling result.
13.7 Field observations made during sampling. Inventory of petroleum products stored in or near each structure sampled.
13.8 Field screening, qualitative, or quantitative results in table form with date and time of measurement.
13.9 Field screening results in table form with date and time of measurement, depth, location, penetration measurement if taken; time-series graphs and tables if more than one sampling period.
13.10 Measurements/samples collected to measure for the presence of vapors within utilities or structures.
13.11 An evaluation of the potential for petroleum vapors to migrate into structures and subsurface utilities. Including calculations on vapor migration potential under existing site conditions.
13.12 Discussion of sampling or analytical anomalies

14. UTILITY / UTILITY CORRIDOR INVESTIGATION (if completed)

14.1 Description of utility investigation
14.1.1 Description of methods used to evaluate potential for petroleum (free phase, dissolved phase, and vapors) to impact buried utilities. (backhoe pits, borings and monitoring well installation, vapor sampling, heated headspace sampling, and other field screening methods). A separate description should be described for each method used.
14.1.2 QA/QC plan (may be on file at DEQ).
14.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file.
14.2 Detailed site map of buried utilities and service connections showing soil contamination and investigation points.
14.3 Description of utility construction materials (including gaskets), bedding materials, and any other information pertinent to contaminant permeation or migration.
14.4 Description of test pits, boring completion, or other utility excavation/inspection.
14.5 Field observations of utility construction, contamination present, and condition of utilities. Include any other observations pertinent to contaminant permeation or migration.
14.6 Field screening results in table form with date and time of measurement, depth, location, penetration measurement if taken.
14.7 Soil sample results.
14.8 Groundwater sampling results (if encountered and sampled from excavation/borings).
14.9 Depth to water and water table elevation measurements (if encountered in excavation/borings).
14.10 Geologic cross-section from borings/excavations showing utility corridors in relation to contamination (if applicable).

14.11 Observations, field screening data, and sample results from material inside utilities (vapors, water, gas…). (if sampled)
14.12 Discussion of sampling or analytical anomalies.

15. OTHER DATA RESULTS (if completed)

15.1 Initial landfarming information (see DEQ landfarming application form) including location map, property ownership, identity of party responsible for tilling and testing, slope of land, soil type, clay content, depth to groundwater, surface water locations, potential environmentally sensitive receptors, nearby residences, present land use and surrounding land use, contaminated (estimated or actual) soil quantity, contaminant concentrations, tilling equipment to be used, tilling intervals, sampling tests and intervals, permits required, stockpiling, berming, cover, local contacts.

16. MIGRATION PATHWAYS AND EXPOSURE POTENTIAL EVALUATION (if completed)

16.1 Evidence of, and the potential for, contaminant to migrate to receptors through pathways of air, soil, groundwater, surface water, sediments and subsurface utility lines.
16.2 Identification and initial evaluation of known and potential human exposure to contaminants present at the facility by inhalation, dermal contact or ingestion of contaminants.
16.2.1 Drinking water from well.
16.2.2 Drinking water from public supply (aquifer contaminated or pipe permeated).
16.2.3 Vapors migrating inside or damaging buried utility.
16.2.4 Vapors migrating into structure
16.2.5 Direct dermal contact with surface (<2ft bgs) contamination.

17. DISCUSSION and EVALUATION

17.1 Technical conclusions and recommendations, which must be stated with reasonable professional certainty and under the standard of care applicable, must include at least a discussion of the following:
17.1.1 Source of the release;
17.1.2 Current extent of and potential for the release to migrate (determined with field or laboratory analytical detection equipment) in or through the following media:
17.1.2.1. Soil; lateral and vertical extent of fuel-soaked soil;
17.1.2.2. Water; dissolved phase (water soluble constituents);
17.1.2.3. Air (vapor phase); and
17.1.3 Aerial extent of free product and the potential for free product to migrate.
17.2 Contamination of soil, groundwater, air; discussion of analytical results, direction of transport, potential receptors of contamination (including utility corridors) from each medium, known, probable and possible impacts to human health and environment from contaminated soil, groundwater, vapors.

18. CONCLUSIONS

18.1 Summarize extent and magnitude of contamination.

18.2 Threats to human health and the environment (present and potential).
18.3 Discussion of Sampling results in comparison to regulatory standards and screening levels.
18.4 Discussion of vertical extent of soil contamination and potential for future leaching to groundwater.
18.5 Discussion of fate and transport of contaminants from known and suspected sources.

19. REMEDIAL ACTION ALTERNATIVES ANALYSIS (if completed)

Remedial alternatives analyses may also be prepared as stand-alone reports following completion of remedial investigations. A stand-alone report format can be found in Remedial Alternatives Analysis Report (RAA-01).

The PRS project manager will provide specific guidance on how to prepare and submit alternatives analysis information and on which remedial alternatives to evaluate.

19.1 Description Of Remedial Actions Being Evaluated
- 19.1.1 Discussion of how remedial actions were chosen for further evaluation.
- 19.1.2 Detailed description of each remedial action proposed.

19.2 Evaluation And Comparison Of Proposed Remedial Actions
- 19.2.1 Discussion of how each remedial alternative achieves comparison criteria
  - 19.2.1.1. Cost
  - 19.2.1.2. Performance - Protection of human health and the environment
  - 19.2.1.3. Performance - Environmental Requirements, Criteria, or Limitations
  - 19.2.1.4. Reliability
  - 19.2.1.5. Implementation
  - 19.2.1.6. Safety
  - 19.2.1.7. Effects on public health and the environment
- 19.2.2 Table summarizing comparison of remedial alternatives against evaluation criteria
- 19.2.3 Discussion and selection of best remedial action based on comparison of evaluation criteria.

19.3 Implementation Considerations
- 19.3.1 Sampling or treatability studies required to finalize the proposed remedial action design.
- 19.3.2 Confirmation sampling required to confirm compliance with cleanup goals following completion of the proposed remedial action.

20. RECOMMENDATIONS

Additional data collection, next phase of investigation (corrective action, second phase of remedial investigation, ongoing groundwater monitoring, no further action)

20.1 Immediacy of corrective action if required.

20.2 Projected future monitoring needs, and justification for all other work proposed for the site.
20.3 Signature page (signed and dated).

21. LIMITATIONS

22. REFERENCES

23. APPENDICES (include only those that apply)

23.1 Sampling methods.
23.2 Boring logs.
23.3 Well completion logs.
23.4 Vapor logs.
23.5 Field data sheets.
23.6 Other logs.
23.7 Sampling summary tables, which clearly identify by the date on which the samples were taken, all of the following: sample ID#, sampling location, sample type, date analyzed, laboratory conducting the analysis, analytical method, and results of the analysis.
23.8 Laboratory reports that include:
  23.8.1 original, or copy of original, sample concentration reports;
  23.8.2 chain of custody documentation;
  23.8.3 sample receipt checklist(s);
  23.8.4 quality assurance/quality control report(s); and
  23.8.5 chromatograms.
23.9 Other data.
23.10 EPA notification forms.
23.11 QA/QC Plan (unless on file with DEQ or supplied with workplan)
23.12 SOP (unless on file with DEQ or supplied with workplan).

Note: Throughout the process of investigation and remediation of a release from an underground storage tank, many reports will be prepared and submitted to the regulatory agency. Basic reports that will be required on most sites include Site Investigation Reports and Groundwater Monitoring Summary Reports.

The DEQ-PRS requires a certain amount of detail in these reports. A large amount of this detail is duplicated from report to report. The facility location, geology, hydrogeology and sampling protocols should not change significantly. Certain sections of some reports may be excerpted from other reports with little or no modification (e.g., sampling protocol followed for drilling or groundwater sampling, QA/QC procedures, etc.). The tables and maps need to be updated if they include new data, but no major changes are normally needed. The appendices of the document may be from other sources (e.g., sample results from the laboratory) or duplicates (e.g., standard sampling protocol followed. Once a Remedial Investigation Report is prepared for a site, subsequent reports should take less time, effort and cost to prepare.

Report RI-02
Standardized Report for an
Additional Remedial Investigation at a Petroleum Release Site

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY PETROLEUM RELEASE SECTION (PRS)
(Revised October 8, 2003)

The following lists minimal requirements for an Additional Remedial Investigation Report. Some of the listed sections may not apply to the scope of work conducted under the approved RI CAP for the release. Omit any section in the Standardized RI Report which does not apply to the scope of work conducted under the RI CAP, and provide an explanation for the omission in the RI Report.

A Remedial Investigation is intended to determine the full extent and magnitude of contamination associated with a petroleum release and to evaluate the risk it poses to human health and the environment. Following the collection and analysis of field data, it may become apparent that additional investigation will be required to determine the full extent and magnitude of contamination or to evaluate the risk it poses. One or more additional investigation efforts may be required to gather and assess all the necessary information. The PRS project manager will use professional judgment to determine what types of additional investigations or information gathering is necessary to adequately document site conditions and evaluate risk.

Each additional phase of investigation work will produce a report to document current site conditions. Unless specifically specified by the PRS project manager, each remedial investigation report must stand-alone and contain a full breadth of knowledge about the release. An Additional Remedial Investigation Report should not repeat raw data from earlier reports such as laboratory analytical reports, boring logs, field observations or similar kinds of information unless it is relevant and necessary for the current discussion. Summarizations of data such as maps, tables of sample results, and diagrams are appropriate to repeat in Additional Remedial Investigation Reports.

The report format listed herein includes most of the typical technologies that may be required as part of a remedial investigation. Not all of these sections may be required for individual release sites. When sections of this report format are not included in the remedial investigation, omit those sections and make a brief annotation in the report that they were not required.

The following is an example of minimal requirements for a Remedial Investigation Report. If any of the topics do not apply to your situation, please omit the section and provide an explanation in the report.

1. TITLE PAGE

1.1 Title of report ["Phase (#) Remedial Investigation for…"]
1.2 Facility name.
1.3 Facility address.
1.4 DEQ Facility ID Number and Release Number.
1.5 Responsible parties name, mailing address and phone number.
1.6 Consultant's name, address and phone number.
1.7 Contact person's name, mailing address and phone number (if different from above).
1.8 Date report prepared.
1.9 Title and date of approved RI CAP

2. EXECUTIVE SUMMARY

2.1 Executive summary of the report that highlights the significant methods of investigation, findings, conclusions, and recommendations of the investigation.

3. TABLE OF CONTENTS

3.1 Includes titles of report sections and page numbers (please use naming/numbering methodology for main sections listed herein).
3.2 Lists of tables and figures.
3.3 List of appendices.

4. BACKGROUND (updated from previous RI reports)

4.1 When, how, and by whom contamination was discovered.
4.2 Type of products stored at site.
4.3 Type of contamination.
4.4 When and who reported the release to DEQ.
4.5 Summary of initial actions undertaken and by whom.
4.6 Summary of regulatory history.
4.7 Current site status. What work has already been done and what do we already know about the release and its potential threats to human health and the environment?

5. PURPOSE AND OBJECTIVES OF INVESTIGATION

5.1 Specific goals of this investigation
5.2 Identify general tasks, state the purpose and objectives of each task

6. SITE HISTORY (if completed)

If the Site History was requested and completed during the currently reported phase of work, then complete all sub-sections in this report.

If the currently reported phase of work adds information to a previously reported Site History, then include those sub-sections that would be updated with the new information, and note that other sections remain unchanged and cite the previous report that includes information.

If some aspect of a previously reported Site History is unchanged, but it is important to the interpretation the currently reported work, then repeat it in this report and note its relevance.

The DEQ project manager may request an updated Site History to compile or consolidate information located in previous reports.

6.1 History of the ownership and operation of the facility, since at least the time at which the release from the tank could have occurred, including the following:
- 6.1.1 The name, current address and telephone number of all current owners and operators;
- 6.1.2 The name, current address and telephone number (if known) of all past owners and operators,
- 6.1.3 The years of current and past ownership and/or operation,
- 6.1.4 A description of the activities conducted at the site by each current and past owner/operator,
- 6.1.5 A general construction history of the site,
- 6.1.6 Former and existing hazardous material/waste storage areas, lagoons and waste pits, and
- 6.1.7 Waste management history.

6.2 History of operation of ASTs and USTs since at least the time at which the release from the tank did or could have occurred at the site, including the following (some or all of this information may be presented in tabular form):
- 6.2.1 Dates of installation and removal of all existing and former tanks located on the site,
- 6.2.2 Volume of tank(s),
- 6.2.3 Tank and piping construction material,
- 6.2.4 Tank configuration, piping layout, check valves,
- 6.2.5 Overfill/spill protection,
- 6.2.6 Cathodic protection,
- 6.2.7 Date and description of repairs, replacements, modifications to tanks and ancillary,
- 6.2.8 Condition of tank(s)/piping if removed, location and size of perforations,
- 6.2.9 Method and results of product inventory reconciliation (describe and attach copies of product inventory charts).

6.3 A description of all known and suspected leaks, spills, overfills or other releases from the UST, ASTs, and any other petroleum sources located on the site. The following information should be included for each occurrence:
- 6.3.1 Date of release,
- 6.3.2 Date release was reported to the department,
- 6.3.3 Type of product(s) released,
- 6.3.4 Quantity released,
- 6.3.5 Quantity recovered,
- 6.3.6 Known or suspected cause of the release,
- 6.3.7 Location of the release on the site,
- 6.3.8 Cleanup action taken, and
- 6.3.9 Offsite effects.

7. MAPS AND SITE TECHNICAL INFORMATION

All Maps and Technical Information should be re-submitted from previous RI reports and updated where appropriate.

7.1 Facility site map or maps and descriptions or symbols appropriate in scale and scope showing the following within a 500 foot (unless otherwise noted) radius of the site (information may be shown on more than one map for clarity):
- 7.1.1 Existing and former USTs, ASTs, piping, dispensers, and other sources of petroleum,
- 7.1.2 Soil boring, test pit, or other sample locations (if completed),
- 7.1.3 Locations of any other environmental samples collected,
- 7.1.4 Monitoring wells (if completed),
- 7.1.5 Recovery wells (if completed),
- 7.1.6 Other remediation equipment (if installed),
- 7.1.7 Underground utilities on and adjacent to the property (sewer, water, telephone, electric),
- 7.1.8 Above ground utilities (overhead wires)
- 7.1.9 Basements and tile drain and sump systems on the facility and adjacent to the property,
- 7.1.10 Existing and former hazardous material/waste storage areas,
- 7.1.11 Adjacent buildings (structures),
- 7.1.12 Domestic, municipal and irrigation wells.

7.2 Local map (2-3 city block area) showing utilities, residences, wells, business or building use (children's nursery or machine shop?), potential third parties depending on contamination type, property lines, magnitude and extent of soil and groundwater contamination.

7.3 Topographic map of site and surrounding area.

7.4 Surface water technical information and map(s), including:
- 7.4.1 Location and use of all surface water within 1 mile of site,
- 7.4.2 Groundwater/surface water discharge points,
- 7.4.3 Sampling description,
- 7.4.4 Results of laboratory analysis.

7.5 Site map showing the aerial extent of free product based on subsurface investigatory methods (e.g. monitoring wells, soil borings, direct push technology).

7.6 Location, ownership, use and construction of all municipal, domestic, irrigation, industrial and monitoring wells within ½ mile of the site,

8. RECEPTOR SURVEY

8.1 Identification of all potential receptors and migration pathways in the area of contamination and possible migration. **(summarize and updated receptors and migration pathways identified in previous RI reports)**

8.2 Exposure Potential Discussion **(summarize and updated discussion from previous RI reports)**

9. EXTENT AND MAGNITUDE OF CONTAMINATION

Repeat and update all sections of previous RI reports. Identify those sections of the report (to include maps from all sections of this report) that have changed due new or different data.

9.1 Describe evidence of releases of petroleum to the environment including visual and olfactory evidence, results of field screening, laboratory analysis and historical knowledge.

9.2 Types, concentrations and volumes (if applicable) of all released petroleum and hazardous material detected to date at the facility.

9.3 Analytical results for each media sampled shall be summarized in the text and in tables in the body of the report.

9.4 Information and details on the approximate horizontal and vertical extent of soil contamination, on-site and off-site, based on best available information.

9.5 Information and details on the approximate horizontal and vertical extent of free-phase petroleum, on-site and off-site, based on best available information.

9.6 Information and details on the approximate horizontal and vertical extent of petroleum vapors, on-site and off-site, based on best available information.

9.7 Describe and discuss the extent and magnitude of all contamination associated with this release or commingled from other sources that will impact, potential risks to human health and the environment, fate and transport and implications for corrective action. Discuss where the contamination is, how much is there (mass and volume in each location), how it came to be located there, and where it may migrate in the future. Discuss how these data will impact an analysis of cleanup alternatives.

10. SOIL INVESTIGATION (if completed)

If a soil investigation was completed and reported in a previous RI reports, then update and summarize it here. Identify those sections of the report (to include maps from all sections of this report) that have changed due new or different data.

If a soil investigation was not completed in a previous investigation, then report it in the following format.

10.1 Description of soil investigation

10.1.1 Description of methods (backhoe pits, borings and monitoring well installation, vapor sampling, heated headspace sampling, and other field screening methods). A separate description should be described for each method used,

10.1.2 QA/QC plan (may be on file at DEQ),

10.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file,

10.2 Description of soil from test pits, boring completion, or other sample retrieval methods,
10.3 Field screening results (visual, odors, and vapor survey results) in tabular form with date and time of measurement, depth, location, penetration measurement if taken; time-series graphs and tables if more than one sampling period,
10.4 Isopleths of concentrations shown on map, possible cross-section of sampling results, if samples taken from more than one depth,
10.5 Groundwater sampling results (if encountered and sampled from excavation/borings; this information may be included in groundwater investigation section),
10.6 Depth to water and water table elevation measurements (if encountered in excavation/borings; this information may be included in groundwater investigation section),
10.7 Soil type, thickness, and classification below the site of the release,
10.8 Unconsolidated material and bedrock type, thickness, and formation name below the site of the release,
10.9 Soil characteristics (grain size, sorting, origin, texture, permeability, classification),
10.10 Boring logs and monitoring well logs (may be presented in appendix) (contaminant screening levels, sediment olfactory observations and vapor readings, and blow count),
10.11 Geologic cross-section from boring/excavation information (if applicable),
10.12 Soil sample analytical results (presented in tabular form),
10.13 Vertical extent of contamination (Include updated soil contamination extent and magnitude map, if applicable).
10.14 Discussion of sampling or analytical anomalies.

11. GROUNDWATER INVESTIGATION (if completed)

If a groundwater investigation was completed and reported in a previous RI reports, then update and summarize it here. Identify those sections of the report (to include maps from all sections of this report) that have changed due new or different data.
If a groundwater investigation was not completed in a previous investigation, then report it in the following format.

11.1 Description of groundwater investigation
  11.1.1 Description of methods (backhoe pits, borings and monitoring well installation, vapor sampling, heated headspace sampling, and other field screening methods). A separate description should be described for each method used,
  11.1.2 QA/QC plan (may be on file at DEQ),
  11.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file.
11.2 General description and characteristics of aquifers and unsaturated zone below the site of the release, including:
  11.2.1 Hydraulic characteristics,
  11.2.2 Depth to water table (multiple measurements should be presented in a tabular format),

11.2.3 Surveyed water elevations and contours (potentiometric surface),
11.2.4 Water table peizometric surface contour map,
11.2.5 Direction of groundwater flow,
11.2.6 Rate of groundwater flow,
11.2.7 Perched or confined aquifer conditions,
11.2.8 Connections to other aquifers, and
11.2.9 Hydrologic cross sections.

11.3 Description of monitoring well, or sampling point completion (description of well, well construction methods, well construction or completion diagram) (may be presented in appendix).

11.4 Field screening results in table form with date and time of measurement, depth, location, penetration measurement if taken; time-series graphs and tables if more than one sampling period.

11.5 Results of laboratory analysis (multiple measurements should be presented in a tabular format).

11.6 Isopleth (iso-concentration) map depicting at least one analyte for each contaminant type (gasoline, diesel…etc.) that best depicts the extent and magnitude of that contaminant. Consult PRS project manager for selection of analytes depicted.

11.7 Discussion of sampling or analytical anomalies

12. SOIL VAPOR INVESTIGATION (if completed)

If a soil vapor investigation was completed and reported in a previous RI reports, then update and summarize it here. Identify those sections of the report (to include maps from all sections of this report) that have changed due new or different data.

If a soil vapor investigation was not completed in a previous investigation, then report it in the following format.

12.1 Description of vapor investigation
12.1.1 Description of methods used to evaluate potential migration of petroleum vapors into utilities or structures. A separate description should be described for each method used.
12.1.2 QA/QC plan (may be on file at DEQ).
12.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file.
12.1.4 Vapor measuring instrument calibration data.
12.1.5 Type instrument(s) used for vapor measurements.

12.2 Weather conditions during collection of vapor readings.

12.3 Detailed site map vapor sampling locations.

12.4 Description of surface and subsurface structures that may influence the migration of vapors through the soil.

12.5 Description of soil vapor sampling points and soil conditions recorded during driving of sampling points (if taken).

12.6 Field observations made during sampling.

12.7 Field screening, qualitative, or quantitative results in table form with date and time of measurement, depth, location, and penetration measurement if taken.
12.8 Groundwater sampling results (if encountered and sampled from vapor sampling points; This information may be included in groundwater investigation section).
12.9 Depth to water and water table elevation measurements (if encountered in sampling points).
12.10 Geologic cross-section from borings/excavations showing vapor concentrations (if applicable).
12.11 Isopleths of concentrations shown on map, possible cross-section of sampling results if samples taken from more than one depth.
12.12 Map(s) showing the extent of free product, dissolved groundwater phase, and vapors discovered in basements and other subsurface structures and utilities.
12.13 Map(s) showing all structures and subsurface utilities present near the site that are, or may become, impacted by petroleum vapors associated with the release.
12.14 An evaluation of the potential for petroleum vapors to migrate into structures and subsurface utilities. Including calculations on vapor migration potential under existing site conditions.
12.15 Discussion of sampling or analytical anomalies.

13. **STRUCTURE VAPOR INTRUSION INVESTIGATION** (if completed)

If a structure vapor investigation was completed and reported in a previous RI reports, then update and summarize it here. Identify those sections of the report (to include maps from all sections of this report) that have changed due new or different data.

If a structure vapor investigation was not completed in a previous investigation, then report it in the following format.

13.1 Description of vapor investigation
- 13.1.1 Description of methods used to evaluate potential migration of petroleum vapors into utilities or structures. A separate description should be described for each method used.
- 13.1.2 QA/QC plan (may be on file at DEQ).
- 13.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file.
- 13.1.4 Vapor measuring instrument calibration data.
- 13.1.5 Type instrument(s) used for vapor measurements.

13.2 Weather conditions during collection of vapor readings.
13.3 Vapor sample locations shown on map.
13.4 Detailed site map vapor sampling locations with respect to petroleum contamination (soil, free product, groundwater, and soil vapors) to the extent known.
13.5 Description of surface and subsurface structures that may influence the migration of vapors through the soil.
13.6 Description of structure vapor sampling points and other conditions within structures that may influence sampling result.

13.7 Field observations made during sampling. Inventory of petroleum products stored in or near each structure sampled.
13.8 Field screening, qualitative, or quantitative results in table form with date and time of measurement.
13.9 Field screening results in table form with date and time of measurement, depth, location, penetration measurement if taken; time-series graphs and tables if more than one sampling period.
13.10 Measurements/samples collected to measure for the presence of vapors within utilities or structures.
13.11 An evaluation of the potential for petroleum vapors to migrate into structures and subsurface utilities. Including calculations on vapor migration potential under existing site conditions.
13.12 Discussion of sampling or analytical anomalies

14. **UTILITY INVESTIGATION** (if completed)

If a utility investigation was completed and reported in a previous RI reports, then update and summarize it here. Identify those sections of the report (to include maps from all sections of this report) that have changed due new or different data.

If a utility investigation was not completed in a previous investigation, then report it in the following format.

14.1 Description of utility investigation
  14.1.1 Description of methods used to evaluate potential for petroleum (free phase, dissolved phase, and vapors) to impact buried utilities. (backhoe pits, borings and monitoring well installation, vapor sampling, heated headspace sampling, and other field screening methods). A separate description should be described for each method used.
  14.1.2 QA/QC plan (may be on file at DEQ).
  14.1.3 Detailed sampling plans and construction techniques may be referenced and placed in appendices or in standard operating plan (SOP) submitted to DEQ and on file.
14.2 Detailed site map of buried utilities and service connections showing soil contamination and investigation points.
14.3 Description of utility construction materials (including gaskets), bedding materials, and any other information pertinent to contaminant permeation or migration.
14.4 Description of test pits, boring completion, or other utility excavation/inspection.
14.5 Field observations of utility construction, contamination present, and condition of utilities. Include any other observations pertinent to contaminant permeation or migration.
14.6 Field screening results in table form with date and time of measurement, depth, location, penetration measurement if taken.
14.7 Soil sample results.
14.8 Groundwater sampling results (if encountered and sampled from excavation/borings).

14.9 Depth to water and water table elevation measurements (if encountered in excavation/borings).
14.10 Geologic cross-section from borings/excavations showing utility corridors in relation to contamination (if applicable).
14.11 Observations, field screening data, and sample results from material inside utilities (vapors, water, gas…). (if sampled)
14.12 Discussion of sampling or analytical anomalies.

15. OTHER DATA RESULTS (if completed)

15.1 Initial landfarming information (see DEQ landfarming application form) including location map, property ownership, identity of party responsible for tilling and testing, slope of land, soil type, clay content, depth to groundwater, surface water locations, potential environmentally sensitive receptors, nearby residences, present land use and surrounding land use, contaminated (estimated or actual) soil quantity, contaminant concentrations, tilling equipment to be used, tilling intervals, sampling tests and intervals, permits required, stockpiling, berming, cover, local contacts.

16. MIGRATION PATHWAYS AND EXPOSURE POTENTIAL EVALUATION (if completed)

If a migration pathways and exposure potential evaluation was completed and reported in a previous RI reports, then update and summarize it here. Identify those sections of the report (to include maps from all sections of this report) that have changed due new or different data.

If a migration pathways and exposure potential evaluation was not completed in a previous investigation, then report it in the following format.

16.1 Evidence of and the potential for petroleum and/or hazardous material migration pathways by air, soil, groundwater, surface water, sediments and subsurface utility lines.
16.2 Identification and initial evaluation of known and potential human exposure to petroleum and hazardous material present at the facility by inhalation, dermal contact or ingestion of contaminants.
16.2.1 Drinking water from well.
16.2.2 Drinking water from public supply (well contaminated or pipe permeated).
16.2.3 Vapors migrating inside or damaging buried utility.
16.2.4 Vapors migrating into structure
16.2.5 Direct dermal contact with surface (<2ft bgs) contamination.

17. DISCUSSION and EVALUATION

17.1 Technical conclusions and recommendations, which must be stated with reasonable professional certainty and under the standard of care applicable, must include at least a discussion of the following:
17.1.1 Source of the release;

17.1.2 Current extent of and potential for the release to migrate (determined with field or laboratory analytical detection equipment) in or through the following media:

17.1.2.1. Soil; lateral and vertical extent of fuel-soaked soil;

17.1.2.2. Water; dissolved phase (water soluble constituents);

17.1.2.3. Air (vapor phase); and

17.1.3 Aerial extent of free product and the potential for free product to migrate.

17.2 Contamination of soil, groundwater, air; discussion of analytical results, direction of transport, potential receptors of contamination (including utility corridors) from each medium, known, probable and possible impacts to human health and environment from contaminated soil, groundwater, vapors.

18. CONCLUSIONS

18.1 Summarize extent and magnitude of contamination.

18.2 Threats to human health and the environment (present and potential).

18.3 Discussion of Sampling results in comparison to regulatory standards and screening levels.

18.4 Discussion of vertical extent of soil contamination and potential for future leaching to groundwater.

18.5 Discussion of fate and transport of contaminants from known and suspected sources.

19. RECOMMENDATIONS

19.1 Additional data collection, next phase of investigation (corrective action, second phase of remedial investigation, ongoing groundwater monitoring, no further action)

19.2 Immediacy of corrective action if required.

19.3 Projected future monitoring needs, and justification for all other work proposed for the site.

19.4 Signature page (signed and dated).

20. LIMITATIONS

21. REFERENCES

22. APPENDICES (include only those that apply)

Raw data from earlier reports such as laboratory analytical reports, boring logs, field observations or similar kinds of information unless it is relevant and necessary for the current discussion. Raw data collected during this investigation, or data that has not been presented in previous reports should be included in this report.

22.1 Sampling methods.

22.2 Boring logs.

22.3 Well completion logs.

22.4 Vapor logs.

22.5 Field data sheets.

22.6 Other logs.

22.7 Sampling summary tables, which clearly identify by the date on which the samples were taken, all of the following: sample ID#, sampling location, sample type, date analyzed, laboratory conducting the analysis, analytical method, and results of the analysis.

22.8 Laboratory reports that include:

- 22.8.1 original, or copy of original, sample concentration reports;
- 22.8.2 chain of custody documentation;
- 22.8.3 sample receipt checklist(s);
- 22.8.4 quality assurance/quality control report(s); and
- 22.8.5 chromatograms.

22.9 Other data.

22.10 EPA notification forms.

22.11 QA/QC Plan (unless on file with DEQ or supplied with workplan)

22.12 SOP (unless on file with DEQ or supplied with workplan).

Note: Throughout the process of investigation and remediation of a release from an underground storage tank, many reports will be prepared and submitted to the regulatory agency. Basic reports that will be required on most sites include Site Investigation Reports and Groundwater Monitoring Summary Reports.

The DEQ-PRS requires a certain amount of detail in these reports. A large amount of this detail is duplicated from report to report. The facility location, geology, hydrogeology and sampling protocols should not change significantly. Certain sections of some reports may be excerpted from other reports with little or no modification (e.g., sampling protocol followed for drilling or groundwater sampling, QA/QC procedures, etc.). The tables and maps need to be updated if they include new data, but no major changes are normally needed. The appendices of the document may be from other sources (e.g., sample results from the laboratory) or duplicates (e.g., standard sampling protocol followed. Once a Remedial Investigation Report is prepared for a site, subsequent reports should take less time, effort and cost to prepare.